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## RESEARCH MEMORANDUM

### ANALYSIS OF SUBMARINE TENDER MANNING ISSUES

Monica F. Hayes  
Alan J. Marcus

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1. This research memorandum represents the final documentation of a CNA project requested by the Submarine Manpower and Training Division. It analyzes submarine tender manning issues. It assesses current manning levels and personnel policies. The adequacy of current manpower requirements and expected requirements growth are also examined.

2. Enclosure (1) is forwarded as a matter of possible interest.

for   
CHRISTOPHER JEHN  
Director

Navy-Marine Corps Planning and  
Manpower Division

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## **ANALYSIS OF SUBMARINE TENDER MANNING ISSUES**

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A Division of

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#### ABSTRACT

The increased workload at submarine Intermediate Maintenance Activities (IMAs) and problems in adequately manning these facilities could affect submarine maintenance. This research memorandum contains a brief analysis of the personnel and requirements issues involved in submarine IMA manning.

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## INTRODUCTION

The submarine community is concerned that the increased workload at submarine Intermediate Maintenance Activities (IMAs) and difficulties in manning them properly could cause problems in maintaining submarines. Submarine IMAs conduct maintenance that submarine crews do not have the facilities or expertise to complete on their own. The Navy's submarine force relies on IMAs for quick, thorough, and professional repair and maintenance on submarines that must operate independently at sea for long periods of time without the benefit of other repair facilities. Submarine IMAs are found aboard the 12 submarine tenders (ASs) and at the three shore facilities listed in table 1. CNA was asked to study the issues in submarine IMA manning to identify existing problems and investigate their sources.

TABLE 1  
SUBMARINE IMAs

<u>Submarine tender/ support facility</u>	<u>Homeport<sup>a</sup>/location</u>
USS <i>Fulton</i> (AS-11)	Groton, Connecticut
USS <i>Orion</i> (AS-18)	La Maddalena, Italy
USS <i>Proteus</i> (AS-19)	Guam
USS <i>Hunley</i> (AS-31)	Holy Loch, Scotland
USS <i>Holland</i> (AS-32)	Charleston, South Carolina
USS <i>Simon Lake</i> (AS-33)	Kings Bay, Georgia
USS <i>Canopus</i> (AS-34)	Kings Bay, Georgia
USS <i>LY Spear</i> (AS-36)	Norfolk, Virginia
USS <i>Dixon</i> (AS-37)	San Diego, California
USS <i>ES Land</i> (AS-39)	Norfolk, Virginia
USS <i>F Cable</i> (AS-40)	Charleston, South Carolina
USS <i>McKee</i> (AS-41)	San Diego, California
NSSF, <sup>b</sup> New London	Groton, Connecticut
NSSF, <sup>b</sup> Pearl Harbor	Pearl Harbor, Hawaii
TRF <sup>c</sup>	Bremerton, Washington

a. As of September 1986.

b. Naval submarine support facility.

c. Trident Refit Facility.

Submarine IMAs play an increasingly important role in submarine force readiness. Major work, such as primary plant resin discharge, has been shifted from the shipyards to submarine IMAs at an estimated savings of half a million dollars per submarine. Programming decisions by OPNAV to save on overhaul costs and to increase operational

availability have resulted in the adoption of the extended operating cycle/depot modernization period (EOC/DMP) concept. This concept extends the time between overhauls by replacing the first nonrefueling overhaul by a shorter DMP (9 months versus 24 months for the 688-class submarine) that concentrates mainly on modernization. The EOC/DMP shifts additional responsibility for submarine maintenance from the shipyards to the IMA and will result in an estimated savings of \$1 billion over the 1989 through 1992 Five-Year Defense Plan.

Interest in IMA manning is growing also because Ship Manning Documents (SMDs) are being developed for the AS classes. SMDs state the manpower requirements for the operation, maintenance, training, support, and administrative functions required for ships to perform their missions. SMDs serve as the basis for manpower authorizations for ships.

To investigate submarine IMA enlisted manning issues, CNA analysts visited various Fleet and OPNAV offices (see the appendix). In the course of these visits, it became apparent that manning issues can be divided into two categories. The first category concerns the numbers and quality of personnel assigned to IMA billets. The second focuses on potential shortfalls in IMA manpower requirements.

Personnel concerns include perceptions that duty on tenders is not career-enhancing, that submarine tender crew members are not adequately compensated, and that these conditions lead to low retention rates. These negative aspects of submarine tender duty are believed to make it difficult for the Navy to man tenders adequately.

Requirements issues include perceptions that submarine tender manpower requirements are inadequate and that the IMA workload is increasing, exacerbating the problem.

This research memorandum describes a brief analysis of each of these issues, with particular attention given to personnel issues.

## PERSONNEL ISSUES

To facilitate the study of these issues, a data base was constructed from the Longitudinal Enlisted Master Record File [1], which contains data from March 1978 to March 1986. Records for personnel in the following ten ratings were selected:

- Electronics Technician (ET)
- Machinist's Mate (MM)

- Engineman (EN)
- Machinery Repair (MR)
- Boiler Technician (BT)
- Electrician's Mate (EM)
- Interior Communications Electrician (IC)
- Hull Technician (HT)
- Torpedoman's Mate (TM)
- Boatswain's Mate (BM)

Information was extracted to allow study team members to track retention and advancement of personnel by type of duty. Type of duty was determined by examining an individual's unit identification code. Submarine tender duty was defined to include all personnel assigned to the ship, both the operating crew and the maintenance department.

The resulting data set contains background information on 276,155 enlisted personnel in the ten ratings selected and information on 376,084 decisions they made affecting retention. Active Mariners, TARs, and personnel with prior service are excluded from the retention and advancement analysis because of the differences in their career paths.

#### **Is Submarine Tender Manning Adequate?**

In order to investigate the adequacy of submarine tender (AS) manning, manning levels on ASs were compared to those on similar ships to determine if submarine tenders are receiving their "fair share" of manpower inventories. Table 2 contains the ratio of the number of MMs, ETs, MRs, and HTs on board ASs, surface ship tenders (ADs), and repair ships (ARs) to the number of billets authorized in September 1984 and December 1985. The table shows that ASs are receiving about the same proportion of available assets as are ADs and ARs. Manning levels across these three types of repair ships are within several percentage points of each other, sometimes higher, sometimes lower. The rating MM was notably undermanned in 1985, but this problem existed for all three types of ships. Submarine IMA assets in November 1986, shown in tables 3 and 4, reveal that overall manning is 92 percent of billets authorized and 98 percent of the Naval Manning Plan (NMP).

TABLE 2  
RATIO OF PERSONNEL ON BOARD  
TO BILLETS AUTHORIZED

Ship type	<u>MM</u>	<u>ET</u>	<u>MR</u>	<u>HT</u>
<u>September 1984</u>				
AS	.96	.97	.96	1.07
AD	.95	.96	.90	1.04
AR	.97	1.00	.93	1.06
<u>December 1985</u>				
AS	.87	1.02	1.01	1.12
AD	.87	1.06	1.00	1.10
AR	.87	.96	1.00	1.02

SOURCE: References [1] and [2].

TABLE 3  
SUBMARINE TENDER IMA MANNING LEVELS, NOVEMBER 1986

<u>Hull</u>	<u>Billets authorized</u>	<u>Personnel on board</u>	<u>Percentage of billets authorized</u>	<u>NMP</u>	<u>Percentage of NMP</u>
AS-11	518	477	92	503	95
AS-18	518	482	93	500	96
AS-19	520	495	95	497	100
AS-31	611	548	90	586	94
AS-32	611	589	96	593	99
AS-33	611	454	74	586	77
AS-34	614	594	97	601	99
AS-36	613	478	78	508	94
AS-37	729	688	94	632	109
AS-39	528	472	89	511	92
AS-40	528	534	101	508	105
AS-41	662	693	105	630	110
Total	7,063	6,504	92	6,655	98

SOURCE: Reference [3].

TABLE 4

## SUBMARINE SHORE FACILITY IMA MANNING LEVELS, NOVEMBER 1986

<u>Facility</u>	<u>Billets authorized</u>	<u>Personnel on board</u>	<u>Percentage of billets authorized</u>	<u>NMP</u>	<u>Percentage of NMP</u>
NSSF, <sup>a</sup>					
New London	1,208	1,198	99	1,255	95
TRF <sup>b</sup>	652	601	92	640	94
NSSF, <sup>a</sup>					
Pearl Harbor	1,008	949	94	1,043	91
Total	2,868	2,748	96	2,938	94

SOURCE: Reference [3].

a. Naval Submarine Support Facility.

b. Trident Refit Facility.

Although ASs appear to be receiving their fair share of the quantity of personnel in each rating, it is important to look at the quality of these personnel. Table 5 contains the ratio of personnel on board to billets authorized for paygrades E-5 to E-9 in March 1986. No clear pattern emerges of differences in filling submarine and surface tender requirements in senior paygrades, and no evidence exists that tenders are systematically less well-manned than their surface counterparts. The different dates displayed in tables 2, 3, and 4 are due to differing data sources; this does not affect the relative outcomes. Similar results were obtained for the other ratings in the study data base.

In addition to paygrade, other measures of personnel quality were examined. The educational background and AFQT scores of personnel from the study data base are displayed in table 6. Personnel in these ratings who have had submarine tender duty during their careers have educational backgrounds similar to those of personnel with no submarine tender duty, but both their mean and median Armed Forces Qualification Test (AFQT) scores are lower. An examination of median AFQT scores by rating, shown in table 7, reveals that this difference is largely driven by the scores of EMs, a rating traditionally hard to fill and with a large submarine requirement, although personnel who have not served on tenders have consistently higher median scores.

TABLE 5  
RATIO OF PERSONNEL ON BOARD  
TO BILLETS AUTHORIZED, MARCH 1986  
(E-5 TO E-9)

<u>Ship type</u>	<u>MM</u>	<u>ET</u>	<u>MR</u>	<u>HT</u>
Submarine tender	.84	.93	.83	.97
Surface tender	.77	.93	.99	.93

SOURCE: Reference [1].

TABLE 6  
EDUCATION AND AFQT SCORES

<u>Level of education</u>	<u>Submarine tender duty</u>	<u>No submarine tender duty</u>
High school graduate	87%	87%
Non-graduate	11%	10%
Beyond high school	2%	3%
Mean AFQT	60	66
Median AFQT	63	71
Number	28,638	214,789

SOURCE: Reference [1].

TABLE 7  
MEDIAN AFQT SCORES, BY RATING

<u>Rating</u>	<u>Submarine tender duty</u>		<u>No submarine tender duty</u>	
	<u>Score</u>	<u>Number</u>	<u>Score</u>	<u>Number</u>
HT	58	5,692	58	19,378
IC	64	1,213	68	11,454
EM	68	3,227	81	24,973
BT	52	758	57	21,788
MR	60	1,555	60	4,137
EN	53	2,850	53	14,576
MM	74	4,895	79	51,184
ET	83	2,796	85	32,938
TM	58	1,976	61	5,136
BM	48	1,779	50	16,861

SOURCE: Reference [1].

The amount of repair experience and training of enlisted personnel is another measure of quality. The submarine repair Navy enlisted classification (NEC) code 9593 is one indicator of such experience. The NEC, obtainable at submarine IMA facilities, identifies personnel who have had submarine repair experience, and it can be used as a tool to return experienced people to submarine IMAs. Table 8 points out that, although more submarine repair NEC holders are assigned to submarine assets (32 percent of 3,902) than to surface assets (14 percent), the majority (54 percent) of the personnel observed in the study data base in March 1986 are performing other types of duty.

Another IMA repair NEC program is the IMA journeyman NEC program. The journeyman NEC is part of the CNO's program to increase intermediate-level repair productivity. The NEC program is sponsored by the Naval Sea Systems Command (075) to attract IMA-experienced senior petty officers to IMA assignments. To gain the NEC, an enlisted person must: have IMA experience and shop qualifications in one of the specialty areas, take an IMA manager's training course, pass an examination, and obtain a recommendation from the IMA commanding officer. The program includes the five NECs listed in table 9 with 1,131 primary and secondary NEC billets as of November 1986. The NEC-specific selective reenlistment bonuses (SRBs) listed in table 9 are available to individuals who hold these NECs. The bonus is generally one to two bonus multiple levels above the source-rating bonus in Zones



B and C. Fiscal constraints have prevented the extension of the SRB to the 17 additional NECs that will be added to the journeyman program in 1987.

**TABLE 8**  
**SUBMARINE REPAIR NEC HOLDERS, MARCH 1986**

<u>Type of duty</u>	<u>Number of personnel<sup>a</sup></u>	<u>Percentage of total</u>
Submarine tender	850	22
Submarine shore facility	399	10
Surface tender	239	6
Surface SIMA <sup>b</sup>	293	8
Other	2,121	54
Total	3,902	100

SOURCE: Reference [1].

a. From BM, BT, EM, EN, ET, HT, IC, MM, MR, and TM ratings.

b. Shore Intermediate Maintenance Activity.

**TABLE 9**  
**JOURNEYMAN NEC SRBs, FY 1986 AVERAGE**

<u>NEC</u>	<u>Zone A</u>	<u>Zone B</u>	<u>Zone C</u>
EM 4621	2 (2.0)	3.5 (3)	3 (2)
EN 4331	2 (0)	3.5 (0)	3 (0)
HT 4921	2.5 (2.5)	3.5 (1)	3 (2)
HT 4941	2.5 (2.5)	3.5 (1)	3 (2)
MM 4221	3.5 (3.5)	3.5 (3.5)	3 (3)

NOTE: Source-rating SRBs appear in parentheses.

A look at the personnel in the study data base as of March 1986 (tables 10 and 11) reveals that submarine assets have a lower number of journeyman NEC holders (146) than surface assets (341). The proportion

of eligible personnel participating is also lower at submarine facilities. The differences in proportions, statistically significant at the 95-percent level, show that personnel assigned to submarine IMAs are roughly half as likely to participate in the program as surface personnel.

TABLE 10  
JOURNEYMAN NEC HOLDERS

<u>Type of duty</u>	<u>Number of NEC holders<sup>a</sup></u>	<u>Proportion of eligible personnel<sup>b</sup></u>
Submarine tender	101	.02
Submarine shore facility	45	.03
Surface tender	183	.04
Surface SIMA <sup>c</sup>	158	.05

SOURCE: Reference [1].

a. March 1986 inventory.

b. Defined as personnel in the MM, EN, EM, and HT ratings.

c. Ship Intermediate Maintenance Activity.

TABLE 11  
JOURNEYMAN NEC TEST-TAKERS

<u>Community</u>	<u>Total 1986 test takers<sup>a</sup></u>	<u>Number passed</u>	<u>Proportion</u>
SURFLANT	204	61	.30
SUBLANT	185	31	.17
SURFPAC	320	94	.29
SUBPAC	66	13	.20

SOURCE: Reference [3].

a. As of November 1986.

Table 11 also indicates that more personnel in the surface community in both the Atlantic and the Pacific Fleets take the journeyman NEC tests and a higher percentage pass. Thirty percent of the SURFLANT test-takers passed, compared with only 17 percent of the SUBLANT personnel.

Given today's requirements, the data show that submarine tenders are receiving their fair share of available assets. An examination of the ratings in the study data base shows that the proportion of personnel on board to billets authorized received by submarine tenders is similar to that received by other tenders, and inventories are 98 percent of NMP. No clear pattern of discrimination in filling senior paygrades can be discerned.

The quality of submarine tender manpower appears to be similar to that of comparable assets. The AFQT scores of personnel with submarine tender duty during their careers, with the exception of EMs, is only slightly lower than the rest of the population in the selected ratings, and educational levels are almost identical.

NECs can be used as a management tool to retour IMA-experienced personnel to submarine IMA assets. An examination of personnel inventories reveals that there may be room for improvement in the management of personnel with submarine repair NECs and IMA journeyman NECs at submarine repair facilities.

#### **Is Submarine Tender Duty Career-Enhancing?**

A common concern about submarine tender duty is that it leads to a slower promotion path than other types of duty. This concern can cause personnel to have low morale or to avoid submarine tender duty. The paygrade structure of personnel in the study data base was examined for personnel with and without AS duty during their careers. Active Mariners, TARs, and prior-service personnel were excluded due to differences in their career paths. For each length-of-service (LOS) cell, the paygrades of interest were those above where the majority of personnel in that LOS cell resided. In this way, a measure was provided of the proportion of personnel who are advancing faster than the average enlistee, which was used as an indicator of career enhancement.

Table 12 presents the paygrade structure of personnel in the study data base with AS duty during their careers and the structure of those without AS service. At 4 years of service, 31 percent of those with AS experience had achieved paygrade E-5 or above. Similarly, 30 percent of those without AS experience had achieved this level. By 6 years of service, however, 23 percent of those without AS service had reached E-6, compared with only 10 percent for AS personnel. AS personnel also had a slightly lower structure at 10, 16, and 20 years of service.

Promotions of enlisted personnel to E-6 and below is determined by testing, while promotions to E-7 and above are decided by selection board. Recently, promotion boards have been briefed on the importance of submarine tenders to the submarine force because of a perceived bias against nondeploying assignments. On the other hand, the lower proportion of promotions of personnel with AS service might be an indication

that lower quality personnel serve aboard tenders. As noted previously, however, for the ten ratings studied, the educational levels of personnel in the two groups are similar, and with the exception of EMs, AFQT scores are only slightly lower.

TABLE 12  
PERCENTAGE ACHIEVING PAYGRADE BY LOS,<sup>a</sup>  
MARCH 1978-MARCH 1986

<u>Length of service (years)</u>	<u>Paygrade</u>	<u>Percentage with submarine tender duty</u>	<u>Percentage without submarine tender duty</u>	<u>Difference</u>
4	E-5+	31	30	+1
6	E-6+	10	23	-13
10	E-7+	5	8	-3
16	E-8+	14	18	-4
20	E-8+	22	23	-1

SOURCE: Reference [1].

a. In the BM, BT, EM, EN, ET, HT, IC, MM, MR, and TM ratings.

A similar examination was conducted by rating. For seven of the ten ratings, a lower proportion of personnel with AS experience had advanced to selection board paygrades. Interestingly, the ratings with higher proportions (BT, HT, and MR) include three of the four ratings in the data base that have no submarine requirements (BM is the other).

Whether or not the lower paygrade levels are a result of a bias against submarine tender service is not clear, but the promotion path for these personnel does appear to be slower. Analyses that take account of more information about individual personnel could help separate the effects of personnel quality and submarine tender service. Analysis of recent selection board results might also be useful in assessing whether the current experience is different from historical results.

#### Are Submarine Tender Crews Adequately Compensated?

Submarine tenders are classified as class "B" ships, which signifies that the ship performs its primary function, to repair submarines, in port. Consequently, duty on board submarine tenders counts as sea duty for rotation purposes, but personnel do not receive sea pay unless the tender is out of its homeport for over 30 consecutive days. Submarine tenders are rarely out of homeport for that long.

Although the ship rarely leaves homeport, unmarried enlisted personnel in paygrades E-6 and below receive only a nominal allowance for quarters, and no enlisted personnel receive basic allowance for subsistence. Submarine tenders are ships, however, and aside from not receiving sea pay, individuals assigned to them receive the same allowances as any deployed ship in the Navy. Submarine-qualified personnel do not receive time toward submarine pay gates while on a submarine tender, which could lead to a loss of continuous submarine pay for these individuals.

The monthly compensation for an unmarried enlisted E-5 with over four years of service is displayed in table 13. In October 1986, personnel at all types of duty received the same \$1,039.50 base pay. Only shore-duty personnel receive a substantial amount of basic allowance for quarters (BAQ) and basic allowance for subsistence (BAS). Submariners who have met their submarine pay gates receive \$130 per month in submarine pay. Surface warfare personnel and submariners receive \$185 per month in sea pay with an operating tempo of 50 percent. An examination of employment histories of ADs since 1983 reveals that AD personnel receive an average of 90 days a year of sea pay, or approximately \$46.25 a month. The total column in table 13 shows that personnel serving on submarine tenders do receive lower compensation than the other groups.

TABLE 13  
MONTHLY COMPENSATION FOR E-5s WITH OVER FOUR YEARS OF SERVICE,  
OCTOBER 1986

Type of duty	Base pay	BAQ <sup>a</sup>	BAS	Submarine pay	Sea pay	Total
Submarine	\$1,039.50	\$ 8.70	--	\$130.00	\$185.00	\$1,363.20
Surface warfare	1,039.50	8.70	--	--	185.00	1,233.20
Shore	1,039.50	210.90	\$182.10	--	--	1,432.50
AS	1,039.50	8.70	--	--	--	1,048.20
AD	1,039.50	8.70	--	--	46.25 <sup>b</sup>	1,094.45

a. Unmarried personnel.

b. Average per month.

### Is Retention of Submarine Tender Personnel Low?

Submarine tender crews work on submarines only when the submarines are in port, which frequently leads to weekend and shift work. Also, as seen in the two previous sections, crew members receive lower compensation than other groups and seem to have a slower promotion path. These factors together could lead to a low retention rate.

Retention rates for personnel in the study data base are displayed in table 14. First-term decisions are defined as reenlistment, extension, and eligible losses that occur during the first 74 months of service. Second-term decisions are those made from 75 to 120 months of service, and career decisions are those made at greater than 120 months of service. An individual could have made more than one decision during a particular term, such as an extension followed by a reenlistment. Each decision was recorded separately. Active Mariners, TARs, and prior-service personnel are again excluded because of differences in their career paths.

TABLE 14  
RETENTION RATES,<sup>a</sup> MARCH 1978-MARCH 1986

Type of duty <sup>c</sup>	Percentage of personnel <sup>b</sup> retained after:					
	First-term decision		Second-term decision		Career decision	
Submarine tender	53	(7,589)	74	(1,243)	97	(2,629)
Surface tender	45	(7,187)	77	(1,059)	96	(2,339)
Submarine shore facility	66	(704)	73	(754)	94	(560)
Surface SIMA <sup>d</sup>	60	(1,012)	74	(2,115)	97	(2,238)
Other	54	(107,790)	70	(27,888)	95	(39,671)

SOURCE: Reference [1].

a. Of personnel in the BM, BT, EM, EN, ET, HT, IC, MM, MR, and TM ratings.

b. The numbers in parentheses are the number of decisions made.

c. At the time of the decision.

d. Ship Intermediate Maintenance Activity.

Table 14 reveals that 53 percent of first-term enlisted personnel serving aboard submarine tenders elect to stay in the Navy. This rate is higher than that for first-term personnel on surface tenders, but about the same as the overall rate for first-term personnel. Submarine

shore facilities have a higher first-term retention rate (66 percent) than surface SIMAs (60 percent), although both are substantially higher than average. An inspection of second-term and career rates shows fairly consistent retention across all types of duty.

A breakdown of first-term, second-term, and career retention rates by rating and by duty type yielded similar results. Although submarine tender duty is viewed by many as undesirable, low retention among enlisted submarine tender crews is not an apparent problem. Perhaps enlisted personnel, who rarely serve consecutive tours aboard submarine tenders, look ahead to their next assignment when making retention decisions, so the current duty station is of little importance when making these decisions.

#### REQUIREMENTS ISSUES

The submarine force relies on IMAs to provide immediate repair and maintenance service to submarines whenever required. When submarines are in port, they are usually being worked on. Due to operational schedules, maintenance must often be conducted on weekends and holidays so that submarines can quickly be turned around. Officers familiar with submarine IMA operations feel that manpower requirements are inadequate to maintain this pace and that pressure on requirements is increasing due to an increasing workload.

#### Are Submarine Tender Manpower Requirements Adequate?

The adequacy of current manpower requirements depends on the workload placed on IMA personnel and on the success of the IMAs in completing necessary maintenance. To address these issues, data on maintenance actions were collected.

Ships' Maintenance and Material Management (3-M) system data on deferred-maintenance actions performed on submarines in FY 1985 were acquired from the Navy Maintenance Support Office, a department of the Ships' Parts Control Center in Mechanicsburg, Pennsylvania. The 3-M system is the major source of Navy data on maintenance performed. An examination of the IMA records for FY 1985, however, reveals that 10 percent of the IMA manhour fields contain zeroes or blanks. Clearly, data on manhours from the 3-M system are not complete.

The IMA records should contain information on all maintenance performed by IMAs on submarines. At most, 3-M records could show current manpower at IMAs as being fully utilized. These records would not be a measure of the amount of work being deferred. Work not being performed due to inadequate quantity or quality of manpower would not be reflected in 3-M data. Conversations with submarine IMA-experienced personnel reveal that recording this data is typically the responsibility of the most junior enlisted person in the department, which could account for the incomplete data records. As a result of these problems

with the data, no conclusion could be drawn about the adequacy of current manpower requirements.

The IMAs are provided with Commercial Industrial Services (CIS) funds to ease the maintenance workload at the IMA by giving defense-related work to small contractors. In the past, a portion of CIS funds have not been used by the submarine IMAs. On the surface, this indicates that additional manpower is not necessary. These funds, however, may be inappropriate for submarine maintenance. CIS funding may only be used to pay small contractors for uncontrolled work that does not affect the safety of the ship. At many locations, submarine IMAs have had difficulty finding suitable contractors. Even when suitable contractors are available, the contracting process may be too lengthy for contractors to complete unplanned, quickly needed repairs. Lack of use of CIS funds therefore does not necessarily mean that manpower requirements are adequate.

A Ship Manning Document (SMD) for the AS-36 class of submarine tenders was completed in February 1987. Draft SMDs for the remaining five classes of submarine tenders are scheduled to be completed by the end of FY 1988.

The Navy's SMD program was developed to determine the minimum quantity and quality of manpower needed aboard a ship in an at-sea wartime environment. An assumption of the program is that manpower requirements are based on full-combat capability. Full-combat capability is assumed to be the most manpower-intensive contingency; therefore, determining a ship's wartime deployment requirements also provides for the ship's peacetime requirements.

The SMD program bases manpower requirements on the Navy's standard 81-hour work week for military personnel afloat, with 67 hours available for work by nonwatchstanders and 11 hours available for watchstanders. As a result, when a ship is in port it can typically complete its peacetime maintenance requirements and maintain a reduced work schedule.

Because submarine tenders perform their primary mission in port, the assumption that an at-sea wartime environment is the most manpower-intensive contingency is not well suited to the submarine tender's mission. Whether wartime manpower requirements on a submarine tender will be greater than peacetime requirements is not clear. IMA personnel rarely perform watchstanding duties and therefore are assumed, in the calculation of the SMD, to produce 67 hours of productive work each week. As a result, if the SMD is calculated correctly, submarine tender personnel would be required consistently to work 81-hour work weeks to complete their assigned duties.

Personnel aboard submarine tenders do not receive sea pay unless the ship is away from homeport for more than 30 consecutive days. The SMD process assumes these personnel work an 81-hour sea duty work week



while in port (with no compensatory sea pay). Maintaining that type of work schedule in port is extremely difficult and, in practice, is not done on a long-term basis.

Fleet personnel express particular concern about the Radiological Control shop (R5), the Outside Machine shop (R9), Quality Assurance (R8), the Nuclear Repair Office (R10), and the ET and MM ratings. Personnel in these shops require special expertise, and frequently either training is not provided in schools or skills can only be learned on the job.

Although most Fleet personnel questioned about manpower requirements view them as inadequate, citing long hours and shift work, true manpower requirements cannot be determined with the data available. In conjunction with the new SMDs, analyses to more accurately determine maintenance requirements are underway in the Navy. An evaluation of the adequacy of current manpower requirements may be feasible upon completion of those analyses.

#### **Is the IMA Workload Increasing?**

In addition to questions about the adequacy of manpower requirements, personnel are also concerned that the IMA workload is increasing. Both the amount and type of work performed at the IMAs is believed to be expanding.

The current number of SSNs in the submarine force will be maintained with the introduction of the new submarine classes and the retirement of some of the older models. The number of SSBNs is slowly increasing, but will peak soon. The total number of submarines should remain relatively stable thereafter. The effect on workload of the retirement of older submarines and the introduction of new submarines was not examined.

The extended operating cycle/depot modernization period (EOC/DMP) for the 688-class SSNs, scheduled to begin in 1989, will replace the first nonrefueling overhaul by a DMP. The shorter DMP (a 9-month versus a 21- to 24-month overhaul) will result in five additional 688s being available to the Fleet, on average. The DMP will perform modernization, not corrective maintenance. Some of the omitted maintenance will be shifted to the IMA, resulting in an increase in the workload for IMAs by an estimated 10 percent per 688 [4]. From 60 to 70 percent of an IMA's workload is submarine maintenance, and by 1989 approximately one-third of the submarines in the submarine force will be 688s. This implies an increase in tender workload of approximately 3 percent, depending on the mix of submarines.

The current policy of the submarine type commanders in both the Atlantic and the Pacific Fleets is to assign work to the IMAs up to the limits of the IMAs capacity and capability. The goal is to fully

utilize the IMA first, and only then to assign work to the shipyards. Many Fleet personnel feel this policy has led to a gradual shift of work from the shipyards to the IMAs over the last seven or eight years.

There is no clearly defined line for IMA versus depot-specific work. If the submarine's hull must be cut or the job is very labor-intensive, the work will usually be referred to a shipyard for completion. Over the past five years, however, primary plant resin discharges and the overhaul of leaky valves has been shifted from the shipyard to the IMA.

Data on submarine operating and support costs were obtained from the Visibility and Management of Overall Support Costs (VAMOSC)-Ships [5]. Table 15 displays the weighted sum of the class-average costs for IMA and depot-level maintenance for SSNs and SSBNs. Each class average was multiplied by the number of submarines in that class to obtain total expenditures at each level. IMA and depot-level maintenance costs are obtained from different sources and calculated in different ways. As a result, the level of effort as measured by cost cannot be compared across maintenance levels. The trends at each level, and in the ratio of measured costs, can be analyzed.

TABLE 15  
OPERATING AND SUPPORT COSTS  
(Millions of constant 1981 dollars)

<u>Fiscal year</u>	<u>IMA</u>	<u>Depot</u>	<u>Ratio of IMA/depot</u>
1981	\$37.10	\$1,443	.026
1982	\$38.70	\$1,614	.024
1983	\$49.10	\$1,626	.030
1984	\$42.80	\$1,760	.024
1985	\$43.90	\$1,758	.025

SOURCE: Reference [5].

The ratio of maintenance effort remained essentially constant over the period studied. This result does not appear to support the hypothesis that work has been shifted from the depot level to the IMA. At the same time, however, there has been an upward trend in the amount of maintenance conducted at the IMAs.

Submarine IMA workload is largely a function of the type commander's policy. The VAMOSC-Ships cost data seem to support the contention that the submarine IMA workload is rising, but not from a

decrease in shipyard workload. The EOC/DMP program is likely to increase the workload for 688-class submarines at the IMAs.

#### SUMMARY

The submarine force relies on submarine tender and submarine shore IMAs for quick, thorough, and professional repair and maintenance of submarines that operate for long periods without the benefit of other repair facilities. As a result, adequate submarine IMA manning is necessary to maintain submarine operations. Fleet concerns about manning make this an important issue in the submarine community.

Meetings with OPNAV and Fleet personnel reveal several prevalent perceptions. Concerns about manpower requirements include perceptions that current IMA requirements are inadequate and that the workload is increasing. Personnel issues include perceptions that manning is inadequate, duty is not career-enhancing, submarine tender crews are not adequately compensated, and personnel retention is low. These problems are perceived to make it difficult to man the tenders adequately.

Analysis of personnel inventories in selected ratings shows that, given today's manpower requirements, submarine tenders are receiving their fair share of available assets. The quality of these personnel (as measured by education and AFQT scores) is similar to that of other activities, although NEC management of submarine IMA assets could be improved.

An examination of the paygrade structure of personnel with submarine tender duty during their careers in the ratings data base supports the contention that these personnel have a slower promotion path, particularly to paygrade E-6. Whether the cause of this slower rate is submarine tender service or the quality of the personnel could not be determined without further analysis.

Personnel serving on board submarine tenders do not receive sea pay unless they are away from homeport for over 30 consecutive days. Unmarried enlisted personnel in paygrades E-6 and below receive only nominal basic allowance for quarters and no enlisted personnel receive a basic allowance for subsistence, even though submarine tenders spend an overwhelming majority of their time in homeport. The average enlistee on a submarine tender receives lower compensation than other personnel in most other types of duty.

Virtually everyone questioned views submarine tender duty as undesirable, but retention rates of personnel at submarine repair facilities are about the same as those of other groups in the study data base. Personnel may be looking ahead to their next assignment when deciding whether or not to stay in the Navy.

The adequacy of current requirements for submarine tender manpower could not be determined from the data available. The lack of accurate maintenance requirements data leaves this fundamental question unresolved. Analyses underway as part of the development of new SMDs may provide information on this issue.

The SMD program, which determines manpower requirements, assumes that an at-sea wartime environment is the most manpower-intensive contingency for ships. This assumption was found to be ill-suited for submarine tenders, whose primary mission is performed in port.

Evidence suggests that the submarine maintenance workload at the IMAs is increasing. Current policy in both Fleets is to assign work to the IMAs up to the limits of their capacity and capability. IMA/depot maintenance cost ratios remained relatively constant from 1981 to 1985, although the IMA workload appears to have increased. Estimates predict that the EOC/DMP program for the 688 SSN will further increase the IMA workload.

Submarine IMA manning is a complex issue that involves both the surface and submarine community. This study briefly analyzed several of these issues.

## REFERENCES

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